Space Weather Technical Forecast

Issued on Tuesday, 09 November 2021 at 12:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active Electron Fluence on day 1, trending downwards.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity has been Very Low over the past 24 hours, with occasional B-class flare activity, mainly from AR2985 in the northeast. This group showed growth during the start of this period before stalling, and is now classified Dao/Beta. There are two other sunspot regions on the disc, AR2893 in the northwest and AR2894 in the southeast, both of which are now simple unipolar features classified Hsx/Alpha. AR2891, the sunspot group responsible for recent activity, has now largely rotated off the visible disc.

No Earth-directed (CMEs) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR and ACE at L1, saw a slow overall decline from around 400 km/s to near 350 km/s, with a brief peak of 430 km/s around 08/1700 UTC. The solar wind density was mainly average or below average, with some short-lived peaks above average between 08/1800-09/0000UTC, peak of 16 ppcc. The IMF, Bt, was weak at 6 nT or below, and the north-south component, Bz, varied weakly between +5/-4 nT. The phi angle was negative (towards the Sun) until around midnight UTC, then switched to positive (away from the Sun). The geomagnetic activity in this period was Quiet (Kp 1-2), with an Unsettled interval 08/2100-0000 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels. The high energy electron flux (greater than 2 MeV) showed the diurnal oscillation about the High flux threshold, peaking at 3320pfu at 08/1850UTC. The 24-hour integrated fluence was just above the Active threshold, with a very slight rising trend later in the day, and 1.26e8 integrated pfu recorded at 09/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is Likely to be Low in the period, with a slight chance of M-class flares - most likely from AR2895.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are expected, however up to two slow and weak CMEs could just give a weak glancing blow, most likely on Day 3 (11 Nov), but with minimal impacts expected. Solar wind speeds are now down to ambient levels, and likely to stay that way through the next four days. Coronal hole 18 may possibly give a rise in wind speeds later on Day 4 (12 Nov), perhaps to around 500 km/s. However, any increase in wind speeds is low confidence.

Geomagnetic activity is expected to be Quiet to Unsettled, with a low risk of Active intervals on Days 3 and 4 due to possible weak CME influence and then possible CH18/- interaction

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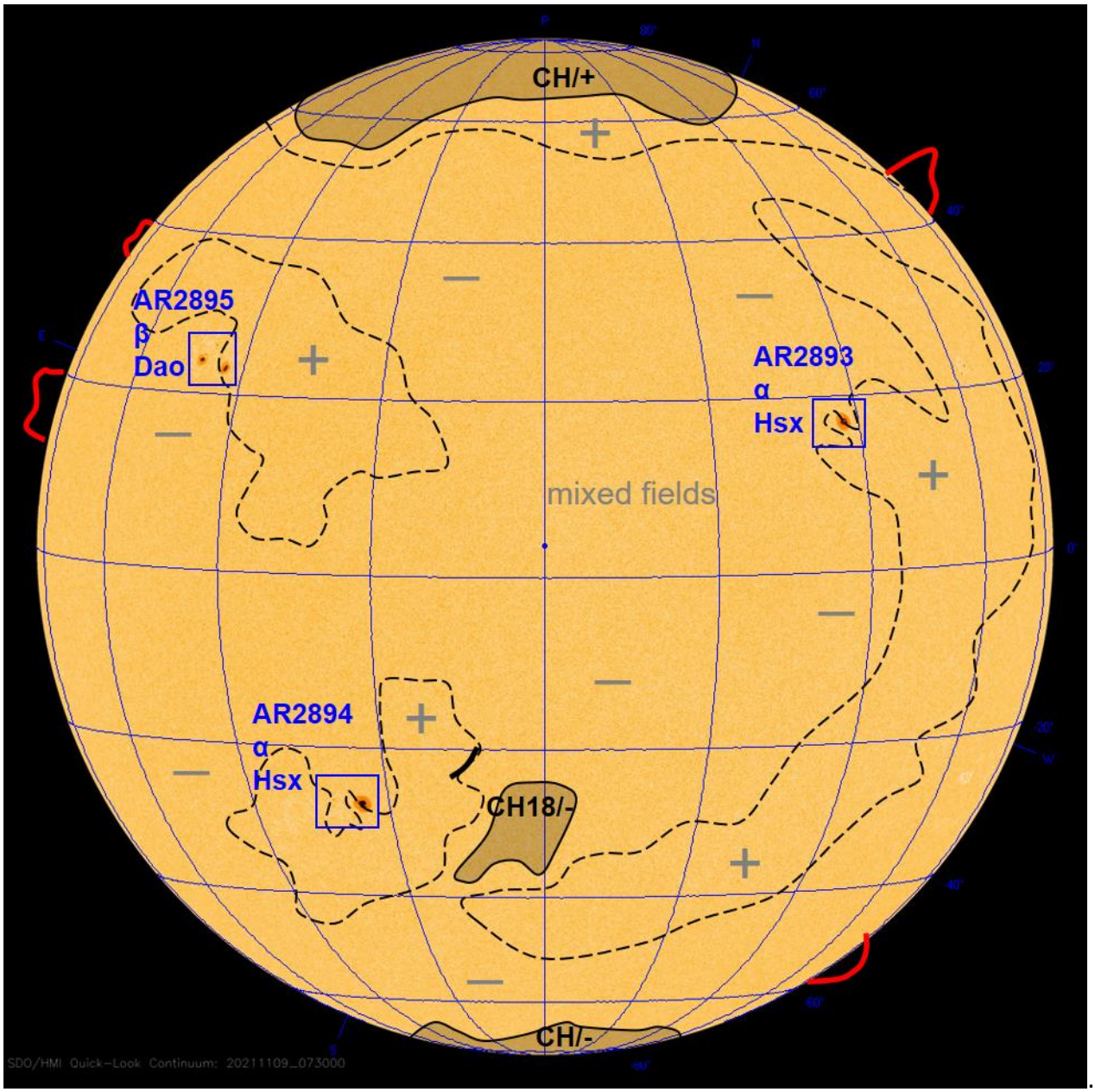
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels.

The high energy electron flux (greater than 2 MeV) is likely to continue to peak at High levels through the next few days, although with a slowly declining trend. 24-hour electron fluence is currently just above the Active (1e8 integrated pfu) threshold and is likely to slowly decline, although the rate of the reduction is low confidence.

Figure 1. Solar Analysis Valid 09/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are expected in the period, however up to two weak CMEs are expected to pass ahead of Earth. A weak glancing blow is just possible, most likely on Day 3 (11 Nov) if it occurs, as hinted at by a small number of MOSWOC Enlil ensemble members. Both CMEs are relatively slow and weak, with any potential impacts likely to be minimal.
Solar wind speeds are now at slow ambient levels, and likely to stay that way through the next four days. It now seems that CH17/+ has missed us, and as such we are unlikely to see any effect from this feature. There is a further coronal hole, CH18/-, just approaching centre disc in the southern hemisphere. This feature may give a rise in wind speeds later on Day 4 (12 Nov), perhaps to around 500 km/s. However, this feature is different to last rotation, and is located well south of the solar equator compared to Earth (north of the equator), so on balance any significant interaction seems unlikely.

Geomagnetic activity is expected to be Quiet to Unsettled, with a low risk of Active intervals on Days 3 and 4 due to possible weak CME influence and then possible CH18/- interaction.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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Radio Blackouts - X-Ray Flares:

Solar activity is likely to be Low during this period, with a very slight chance of M-class flares. Although AR2895 in the northeastern quadrant grew very rapidly around 24 hours ago, it has since stabilised as a Dao/Beta group which is relatively magnetically simple. It has been responsible for occasional B-class flares during the period. There are two other regions on the visible disc, but both are now mature and simple Hsx/Alpha regions.

At the present time no regions are due to leave or return in the period, with a stable trend therefore expected, but any renewed development of AR2895 may change the probability of flaring.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is at background levels, and is forecast to remain at these levels through the period.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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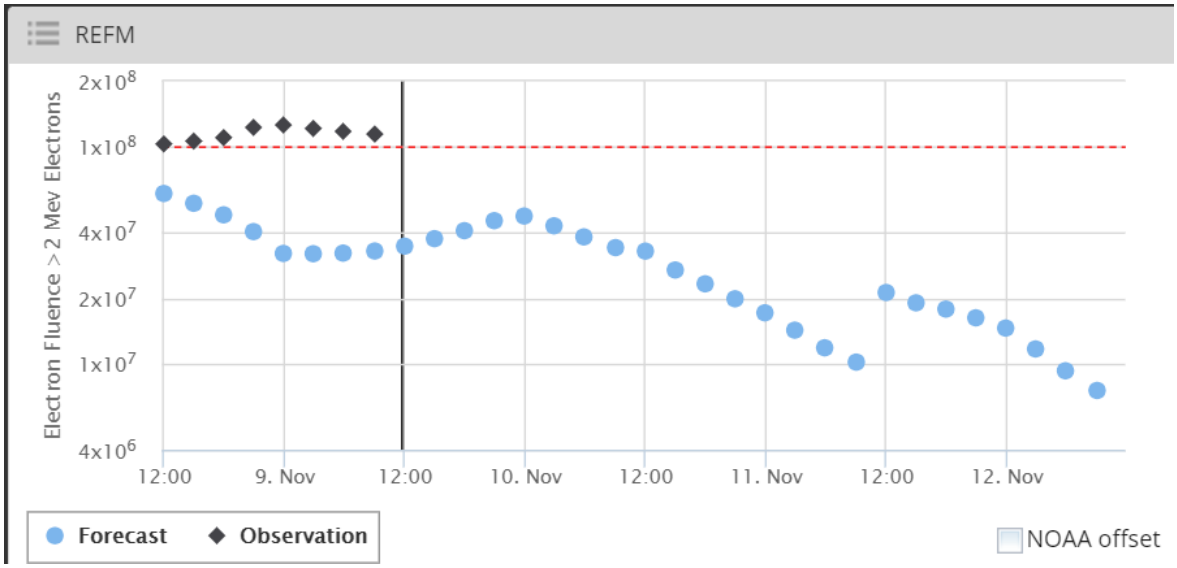
High Energy Electrons Event (≥ 2MeV):

The observed high energy (greater than 2 MeV) electron flux at GEO is at Moderate to High levels, after the recent CME brought a period of elevated to strong solar winds. With wind speeds now down to near background levels, the high electron flux is expected to gradually decay through the next four days, however the speed of any decay is very low confidence.

The associated 24-hour electron fluence is currently just above the Active threshold, and is now showing a slow downward trend. This trend downwards is expected to continue during the next four days but the speed of this trend is low confidence. REFM is signalling a fairly rapid downward trend over the next 3 days, which is likely to be a little too fast.

GEO Electron Environment	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	70	50	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 2: MOSWOC REFM model showing quite a rapid downward trend. This is considered to be a little fast.



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